VEGETABLE CROPS HOTLINE

A newsletter for commercial vegetable growers prepared by the Purdue University Cooperative Extension Service

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<http://www.entm.purdue.edu/entomology/ext/targets/newslett.htm>

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TOMATO DISEASE PRIMER - *(Dan Egel)* - For most areas of Indiana, the weather has been too cool and dry to cause much foliar disease to get started. It won't be long, however, until warmer and wetter weather will cause the usual diseases to infect tomatoes. The following is brief description of some of the tomato diseases I see each summer listed from most to least common. Specific management strategies for these diseases can be found in the Midwest Vegetable Production Guide for Commercial Growers (ID-56) <www.entm.purdue.edu/entomology/ext/targets/ID/index.htm>.

Early blight - The leaf spots caused by this disease are roughly circular and up to 1/2 inch in diameter. The spots contain dark concentric rings in a target-like pattern. The spots first occur on the older leaves and progress upwards. Fruit spots (less common) may occur at the stem end. Such spots are usually brown-black and up to 1 inch in diameter.

Early blight can be managed by rotating away from tomatoes or potatoes for 3 to 4 years. Fall tillage can help get rid of crop residue, which might harbor the disease. Most growers find that protective fungicides are critical to managing early blight.

Septoria leaf spot - Spots on leaves are circular with chocolate brown margins and gray centers. As the spots enlarge (up to 1/8 inch in diameter) small dark spots may be observed within each lesion. These are the reproductive structures of the causal fungus. As in early blight, the spots start on the older leaves first. Manage Septoria leaf spot in the same fashion as early blight.

Bacterial spot - Leaf spots are usually 1/16 inch, black and angular. Spots are more often found on young than old plant tissue. Spots are usually surrounded by yellow plant tissue. Spots on fruit are black, raised and up to 1/3 inch in diameter. The disease prefers warm wet weather.

Bacterial spot may be seed borne; greenhouse grown transplants should be carefully monitored. Tomatoes should be rotated 2 to 3 years away from peppers or tomatoes. Treatment with copper hydroxide may reduce spread in the field. However, copper products will have little effect on tomato disease such as early blight and septoria leaf spot.

Bacterial Canker - Older leaves are often affected first. Leaves may turn downwards and eventually curl. The most characteristic symptom on leaves is the brown necrotic area along the margin of the leaves. Inside the brown area, the leaves are frequently yellow, giving the leaves a scorched appearance. However, other environmental factors can give the leaves a similar scorched appearance. Spots on fruit are usually less than 1/4 inch in diameter and have a characteristic "birdseye" appearance; that is, they are light colored with a dark center.

Bacterial canker is another disease that may be seed borne. Rotations of 2 to 3 years and fall tillage are important in managing this disease. The use of copper products to control the disease in the field has had mixed results. Remember to use good sanitation. For example, use only clean stakes. Reduce the spread of bacterial canker by working the field when the plants are dry.

Other diseases - The above list accounts for about 80% of the tomato disease I see each year. Other diseases include **bacterial speck** of tomato. This disease looks similar to bacterial spot but occurs in cooler weather. Thus bacterial speck is often found earlier in the year.

Circular sunken spots of about 1/2 inch in diameter on ripe to over ripe fruit may be caused by **anthracnose fruit rot**. A gray-green water-soaked spot that may cover half the fruit or more could be **buckeye rot**. A dark rot starting at the blossom end of the tomato fruit is most likely **blossom end rot**. The latter disorder is not a disease at all, but a calcium imbalance, frequently corrected by avoiding wide swings in soil water availability.

Many other diseases and disorders may occur. This list is just a start. Find someone who knows tomato disorders and diseases to know for sure.

So, Just How Clean is Your Water? - *(Shari L. Plimpton)* - As we work through another year of helping growers with the application of Good Agricultural Practices (GAPs) to their fresh produce operations, I am repeatedly reminded of just how important, and potentially confusing, is the issue of water quality. First of all, we emphasize in our education programs that water quality is one of the most critical control points for minimizing the risk of food borne illness. Of course, water contamination of any kind: chemical or microbiological is to be avoided both out in the field and in the packinghouse. In the GAPs program we provide recommendations based on good, general science yet, we emphasize that no standards have been established for fresh produce. Ultimately we end up applying the standards for potable water and wait for the research to tell us if we have any other options or considerations.

I have written before about the standards for water testing and treatment of wells and will repeat just a few words about it here. Anyone who has heard me speak has heard about testing wells annually and open water sources quarterly for fecal coliform and E. coli. During farm consultations we provide Standard Operating Procedures (SOPs) that give growers methods for solving a contamination problem whether it's for water intended for use out in the field, or for water used in the packing house. Those SOPs generally rely heavily on the use of chlorine (in its variety of forms) to treat the water, killing bacteria present in the water and, depending on the level of free chlorine in the water, killing some bacteria on the surface of produce being washed.

And yet the world is a changing place, new problems pop up, and, if we are lucky, new solutions present themselves as well. Some growers are using sanitizers other than chlorine to solve a number of problems inherent to using chlorine (fumes, corrosion, and discharge issues, to name a few). Some of the methods I have seen more commonly employed in the Midwest are copper ionization, and hydrogen peroxide or hydrogen dioxide.

Copper Ionization is an electrical method that generates electrically charged copper ions into a water system. These ions are reactive and are thereby capable of inactivating bacteria, mold, mildew and similar microorganisms. The level of copper used by these automatic systems is not toxic and copper has been effectively used to generally control disease in other applications. The effectiveness of copper ionization on certain spore-forming bacteria and parasites is questionable when it is not monitored or controlled properly. All systems should have a method for being able to monitor the copper ion level in the water. Combination with another sanitizer (i.e. chlorine, hydrogen peroxide, etc.) is a way to cover all of your bases, yet maintaining lower levels of reactive oxidizing sanitizers.

Using hydrogen peroxide or hydrogen dioxide is another acceptable method for achieving water sanitation. Here, we are taking a form hydrogen and oxygen molecules that are highly reactive, bringing them into contact with organic material (bacteria), and (at a high enough level) effectively killing bacteria, parasites and inactivating viruses. One big plus of using these compounds is that the by-products of their reactions are water and oxygen. There is no need to be concerned about fumes or water discharge; however, these are reactive materials and should be handled carefully. Again, monitoring the level of the reactive components is critical to maintaining control over your sanitizing system.

Of course these are only two alternative sanitation methods for water treatment of many. Regardless of the one you choose, the most common error I find is that there is no monitoring system for the water sanitation system. With chlorine, people are accustomed to using test strips to measure the free chlorine levels. If they combine this measurement with monitoring the pH of the water, they can be sure to maintain the right balance in the water to achieve inactivation of microorganisms. A pH that is either too high or too low will result in the chlorine moving into a form that will not be effective for killing microorganisms. And if you simply dump and don't measure, you may just be throwing money down the drain.

Using an ORP system to monitor the effectiveness of your water treatment system may be a more useful and easy method to assure that your treatment system is working for you on a consistent basis. ORP stands for Oxidation-reduction potential. An ORP system is a system that can measure the oxidation-reduction potential (in terms of milli-volts (mV)) of the treated water. Research has shown (Trevor V. Suslow, Ph.D., UCDavis, Pub. 8149, 2004) that a reading of 650-700 mV will result in the killing of pathogenic bacteria within 30 seconds. Advantages of this system can be automated dosing based on system readings, automatic recording of measurements (helpful for those who face third-party audits), and reduction of the need to test the water for pH.

Maintaining backup methods with which to calibrate your ORP system is strongly recommended. Ultimately you should know as much about your water chemistry (pH, mV, free ion levels) as you probably know about the soil chemistry of your fields. Failing to monitor is a failure to control. Water systems that are out of control are at a much greater risk for being the source of a food borne outbreak. Minimize your risk and measure.

Ohio and Indiana fruit and vegetable growers can get help with the development of a food safety program by contacting Mid American Ag and Hort Services by phone at (614) 246-8286, fax at (614) 246-8686, or email at maahs@ofbf.org. The Initiative is presented in partnership with the United States Department of Agriculture's Risk Management Agency. More information about the Ohio and Indiana Specialty Crop Food Safety Initiative may be found at <www.midamservices.org> by clicking on "Projects."

Beneficial Insects - (*Frankie Lam*) - Many insects look similar and are not easy to identify, especially those belonging to related groups or families. Each summer I have growers sending me insects and asking for the method of control; however, more than 10% of the insects that are sent to me are beneficial. For example, most growers cannot distinguish a red lady beetle (predator) from a red-phase bean leaf beetle (pest), a spined soldier bug (predator) from a brown stink bug (pest), and cannot identify the lady beetle eggs, larvae, and pupae. Here I present photos and descriptions of some beneficial insects that are commonly found in fields and orchards.

Lady Beetles or Ladybird Beetles. All lady beetles belong to the same beetle family and most are predators that feed on soft-bodied insects and eggs. The female beetles lay the eggs (Fig. 1A) in small masses of 10 to 20 on leaves of plants that are infested by aphids. Their larvae are carrot-shaped and gradually tapering at the body end, have long legs and short spines or warts at the back (Fig. 1B). Some growers describe a lady beetle larva as a small "alligator." Both larvae and adults of lady beetles feed on aphids and scale insects.

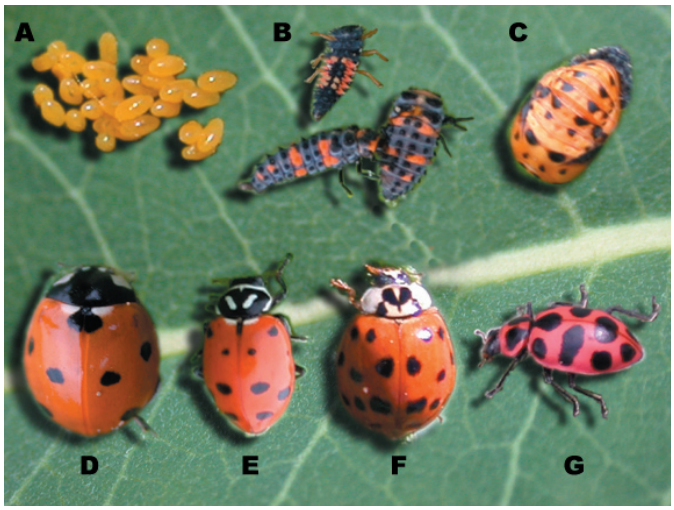

Fig. 1. A) Lady beetle egg mass, B) Lady beetle larvae, C) Lady beetle pupa, D) Sevenspotted lady beetle, E) Convergent lady beetle, F) Asian lady beetle, G) Spotted or Coleomegilla lady beetle. *(Photo by Frankie Lam)*

In summer the larvae pupate on leaf surface (Fig. 1C). The lady beetles that commonly found in fields are the seven-spotted (Fig. 1D), convergent (Fig. 1E), Asian (Fig. 1F), and spotted (or Coleomegilla) (Fig. 1G). The adult beetles are roughly hemispherical in shape, most are red, brown, or tan, and usually with black spots on the wing covers. The red-phase bean leaf beetle (Fig. 2), which belongs to the leaf beetle family, can be distinguished from a red lady beetle by having an oblong body and a black triangle at the back of the collar (thorax). The lady beetles usually do not have or have a different shape of dark spot at the back of the collar. Many adult lady beetles are 1/8 to 1/4 inch long. During fall the adult beetles migrate to woodlands and hibernate in debris.

Fig. 2. Red-phase bean leaf beetle. *(Photo by Frankie Lam)*

Soldier Beetles. Soldier beetles resemble fireflies or lightning bugs, but without light-producing organs. The beetles are about 1/2 inch long, with yellow wing covers and have a broad, black lengthwise mark on rear of each wing cover (Fig. 3). The adults eat pollen, nectar, and small insects. They deposit the eggs in litter or soil. The larvae (Fig. 3 Inset) are predacious on other insects, including grasshopper eggs, caterpillars, and beetles. Some species that are native to the Great Plains are used as biological control agents for corn earworm. Fully-grown larvae pupate in soil and the adults emerge in warm spring.

Fig. 3. Soldier beetle, Inset: Soldier beetle larva. *(Photo by Frankie Lam)*

Ground Beetles. Most species are dark, shiny, and somewhat flattened, with striate wing covers (Fig. 4A). The ground beetle measures 1/8 to 1 1/4 inches long, with narrow head and broad collar. The adults are commonly found under rocks, logs, leaves, or debris or running about on the ground. Nearly all adults and larvae are predaceous and feed on other insects and snails. Some species are commonly known as "caterpillar hunters" (Fig. 4B). If not handled carefully, the caterpillar hunters may inflict a painful bite.

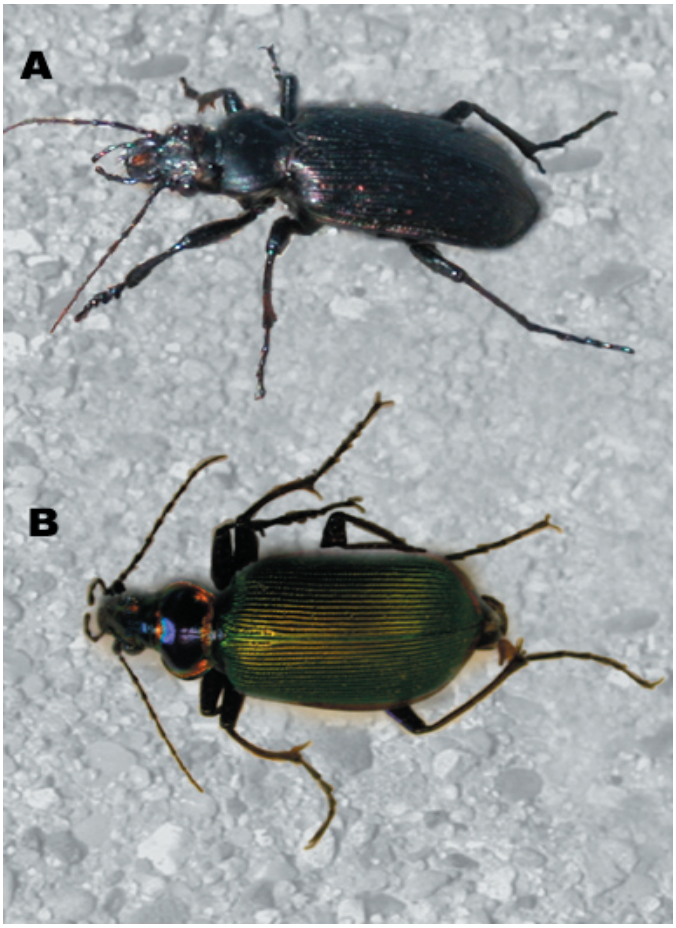

Fig. 4. A) Ground beetle, B) Caterpillar hunter. *(Photo by Frankie Lam)*

Tiger Beetles. Tiger beetles are usually metallic blue, green, purple, or orange in color and some have a definite pattern on the back. The adults range from 3/8 to 7/8 inch long. These beetles have long legs and long antennae and are fast runners (Fig. 5). Both adults and larvae have powerful sickle-shaped jaws (mandibles) and are ferocious predators.

Fig. 5. Tiger beetle. *(Photo by Frankie Lam)*

Lacewings. Lacewings are also known as net-veined insects. The lacewings commonly found in fields are the green (Fig. 6A) and brown lacewings (Fig. 6B). The adult green lacewings measure 3/8 to 3/4 inch, whereas the

Fig. 6. A) Green lacewing, B) Brown lacewing, C) A green lacewing larva feeding on an aphid, D) Green lacewing eggs. *(Photo by Frankie Lam)*

brown lacewings are 1/4 to 5/8 inch long. The larvae of these insects have large, sickle-shaped mandibles and are predators of small insects. The larvae of green lacewings are commonly called aphidlions (Fig. 6C). The green lacewings lay their eggs at the end of a tiny stalk and are easily recognized on plants that are infested with aphids (Fig. 6D).

Hover Flies or Flower Flies. Hover flies are brightly colored flies, from 1/4 to 1/2 inch long, and has black and orange abdomen that resembles bees or wasps (Fig. 7A). The flies can be distinguished from bees and wasps by having only one-pair of wings (bees and wasps have two-pair of wings). These flies do not bite or sting. Adult flies drink nectar and hover in the air above flowers. The eggs are usually laid on plants infested by aphids. The larvae are slug-like and mainly prey on aphids (Fig. 7B).

Fig. 7. A) Hover flies look like small bees or wasps, B) A hover fly larva (lower right) feeding on aphids. *(Photo by Frankie Lam)*

Wheel Bug. Wheel bugs are brown to gray bugs with thin rusty brown antennae. Adults are about 1 1/4 inches long. The bug has a prominent cogwheel emerging from the back of the thorax. Both adults and nymphs are generalist predators and feed on other insects (Fig. 8). The front legs of the bugs are enlarged and used to seize and hold the victims. However, if handled carelessly, the wheel bug may inflict a painful bite on people.

Spined Soldier Bug. The spined soldier bugs are commonly found in fields and gardens. The insect belongs to the stinkbug family, from 3/8 to 1/2 inch long, and have a prominent spine on each "shoulder"

Fig. 8. A wheel bug feeding on a Japanese beetle. *(Photo by Frankie Lam)*

(thorax) and light-orange legs (Fig. 9A). Most stinkbugs, including green (Fig. 9B) and brown (Fig. 9C) stinkbugs, are plant feeders; however, the spined soldier bugs are predators of insects. The brown stinkbug can be distinguished from spined soldier bug by its round shoulders and light-brown legs.

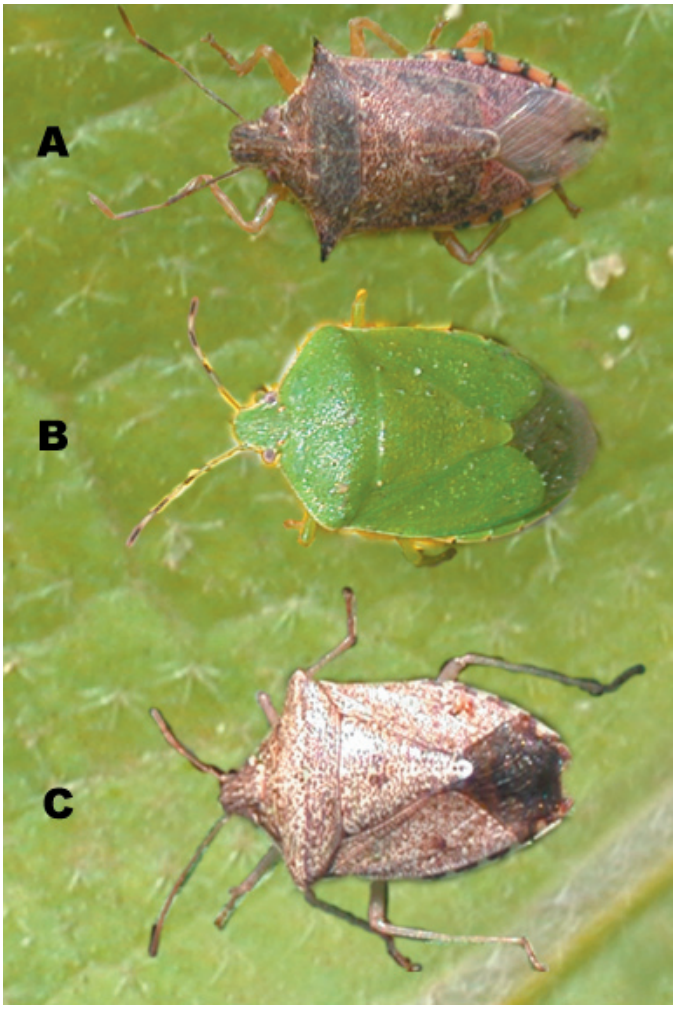

Fig. 9. A) A spined soldier bug has prominent spines on shoulders, B) Green stink bug, C) A brown stink bug has rounded shoulders. *(Photo by Frankie Lam)*

Insidious Flower bug. Adult insidious flower bugs (Fig. 10) are very small (1/10 inch long) true bugs, somewhat oval-shaped, black with white wing patches. Both nymphs and adults feed on a variety of small soft-bodied prey, including insect eggs, aphids, thrips, leafhopper nymphs, small caterpillars, and spider mites. The predator holds its prey with its front legs and feeds by sucking juices from its prey through its needle-like, sharp beak. The insidious flower bug is commonly found in fields and gardens from May through October. They may also feed on pollen and plant juices when prey is not available. The insect occasionally may bite humans; however, they do not feed on blood or inject a venom or saliva.

Fig. 10. Insidious flower bug. *(Photo by Frankie Lam)*

Weed Control Important for Conserving Soil Moisture - *(Liz Maynard)* - In dry conditions like we are experiencing this summer, weeds reduce crop yield in part by using water that crops need. The more ground covered by weeds, the more water they use. Managing weeds is one important practice for conserving soil moisture.

The amount of water used by plants is roughly proportional to the percent of the ground area covered by plant foliage. For instance, the daily water use of a crop that has filled in halfway between the rows will be about one-half the amount of water used by a crop that has entirely filled in between the rows. Similarly, if a crop has filled in halfway between the rows, and weeds cover the remaining ground between the rows, the total daily water use by crop and weeds will be about double that for the crop alone. The exact amount of water use will depend on the crop and weed species, as well as environmental conditions, but as a rule of thumb the percent ground cover can be used to estimate relative water use.

Although the surface of the soil under a cover of crop or weed leaves may look moist compared to soil with no plant growth that is exposed to the sun, the surface moisture does not give a true indication of how much water is in the root zone of the plants. Examining the soil below the surface, in the root zone, will show

that where plants (crop or weeds) are growing, the soil in the root zone dries more quickly (assuming other conditions are similar).

The effectiveness of weed management tools is influenced by the weather. Many preemergence, surface-applied herbicides are not effective if rain (or irrigation) does not occur within a few days of application to move them into the soil where germinating weeds seedlings can take them up. Shallow incorporation can be used as a substitute for rain or irrigation. Even if the herbicide is in the right place in the soil, if conditions are too dry for weed emergence until later in the season, preemergence herbicides may have lost some of their activity by then and weed control may be reduced.

Hot and dry weather can reduce effectiveness of postemergence herbicides also. Under these conditions the leaf surface of weeds becomes less permeable and less herbicide is taken up by the weeds, resulting in poorer control. Use of label-recommended adjuvants with the herbicide should maximize the uptake of herbicide by the weeds. Another way these conditions reduce effectiveness of some herbicides is by causing drought stress in the weeds. Post-emergence grass herbicides for example, are most effective when the grass is actively growing. If possible, schedule application of these materials for periods after a rain or irrigation when the weeds are less stressed.

Cultivation may be more effective under drought conditions because there is a lower likelihood that weeds will survive to re-root. To conserve soil moisture, cultivation should be as shallow as possible while maintaining effectiveness. Anytime wet soil is exposed to the air, soil moisture is lost due to evaporation.

In dry conditions, organic mulch (e.g. straw) used for weed control may actually increase the number of weeds that germinate due to the conservation of soil moisture under the mulch. If the mulch is not thick enough to kill weeds, a mulched area may have more weeds.

Mowing weeds will also reduce their water use. Mowing is probably most effectively used between beds of crops that have an upright growth habit, such as tomatoes or peppers.

I know many growers and their employees are working especially long hours to get water to crops. Water conservation is the other side of crop water management. Managing weeds is an important component of water conservation practices, and is particularly important under drought conditions.

IVGA Directory of Wholesale Vegetable Producers Available - (Liz Maynard) - The Indiana Vegetable Growers' Association Directory of Wholesale Vegetable Producers has been updated. This directory lists Association members who can supply vegetables in quantities from a pick-up load to many semi-trailer loads. It includes a table showing which vegetables are available from each supplier. A copy has been mailed to all current members of the Association. The directory is available on the web at <www.ivga.org>. A hard copy may be requested by emailing your request to ivga@ivga.org, or calling (219) 785-5673.

Pumpkin and Fruit Crops Twilight Meeting Scheduled - A twilight meeting for commercial fruit and vegetable growers is scheduled for Sept. 7, 2005, at the Meigs Farm of Throckmorton Purdue Ag Center in Tippecanoe County. Mark your calendars and watch future issues of this newsletter for more information.

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